THIRD ANNOUNCEMENT

XI SCHOOL
OF THE DIVISION OF GRAVITATION AND
MATHEMATICAL PHYSICS OF THE
MEXICAN PHYSICAL SOCIETY
Quantum Gravity: schemes, models and phenomenology

Playa del Carmen, MEXICO. December 5-9, 2016
http://www.ifug.ugto.mx/~msabido/XI_Escuela/

The Division of Gravitation and Mathematical Physics (DGFM) of the Mexican Physical Society (SMF) is glad to announce the celebration of its XI Mexican School. As in previous events, our main goal is to provide an inviting arena for the exchanging and discussion of ideas on top developments in gravitational physics in a pedagogical manner. Apart from researchers, an important number of postdocs and graduate students take part in our School, which in this occasion will be focused on several schemes of quantum gravity and its phenomenology. The scientific program will include four courses and two or three plenary talks, and two sessions of parallel talks. Further details will appear in forthcoming announcements.

The venue will be the Hotel Iberostar (http://www.iberostar.com/) located in Playa del Carmen, Rivera Maya, Quintana Roo, Mexico, an inspiring place offering cultural features and natural beauty at the Caribbean coast, in a region where a number of Maya cities once flourished.

LECTURE COURSES

- **Giovanni Amelino Camelia** (Sapienza University of Rome), *Recent advances in quantum-gravity phenomenology*
- **Viqar Husain** (University of New Brunswick), *Polymer quantization, time, and quantum gravity*
- **Iván Agullo** (Louisiana State University), *Loop quantum cosmology and the cosmic microwave background*
- **Alan J. Weinstein** (California Institute of Technology, LIGO), *First results from advanced LIGO*

PLENARY TALKS

- **Craig Hogan** (University of Chicago), *Exotic Rotational Correlations in Emergent Space-Time*
- **Jorge Pullin** (Lousiana State University), *Loop quantum gravity with spherical symmetry*
- **Robert Oeckl** (CCM, UNAM), *Operational quantum gravity*
- **Tim Koslowski** (ICN, UNAM), *The Shape Dynamics Description of Gravity*
- **Claus Laemmerzahl** (ZARM, Bremen University), *Analytic theory of accretion disks*

INVITED TALKS

- **Volker Perlick** (ZARM, Bremen University), *Wave equations on Schwarzschild spacetime in regular coordinates*
- **Jorge Alfaro** (Pontificia Universidad Católica de Chile), *Bose-Einstein graviton condensate in a Schwarzschild black hole*

REGISTRATION

To register send an e-mail to Miguel Sabido (dgyfm.smf@gmail.com) including full name, contact details, institution, title + abstract of your proposed talk. An effort will be made to reasonably accommodate as many parallel talks as possible. Only in the event that the parallel session slots are full, we shall include a poster session.

Deadline for title + abstract submission: September 2. We will respond quickly to all talk requests, so that interested participants can benefit from the early payment of the registration fee (see below).

Students
Accommodation: USD $420 (MX$ 7,500) in double occupancy

Registration fee (MX$ Mexican Pesos)
Early. Before September 30: USD 112 (MX$ 2,000)
Regular. Between September 30 and October 28: USD 139 (MX$ 2,500)

Faculty and Postdocs
Accommodation: USD $640 (MX$ 11,500) in single occupancy
                          USD $420 (MX$ 7,500) in double occupancy

Registration Fee (MX$ Mexican Pesos)

Early: Before September 30: USD 167 (MX$ 3,000)
Regular: Between September 30 and October 28 USD 195 (MX$ 3,500)

The hotel rate includes 5 nights (Sunday-Friday) in double or single occupancy, and all meals and drinks during the stay. The registration fee includes coffee breaks.

To share a room with a specific   person, payments should be synchronized as much as possible. Arrival and leaving dates must coincide. Please communicate directly with Guillermo Chacón, (gchacon@correo.cua.uam.mx).
*The hotel charges a daily entrance fee for people not hosting in Iberostar due to its all-inclusive system.

Notice that registration will be closed by November 28. To ensure availability of this special rate, early payment is advised since only a fixed number of rooms have been booked. Those who want to register after this date, or the pre booked rooms have been occupied, must contact the hotel directly* to check for availability.
*Connie Figueroa (grupos.playacar@iberostar.com.mx) Tel. +52 (984) 877 20 00 Ext. 3138

Registration fee payment and receipts

In order to get your receipts for the registration fee please send a copy of the deposit slip to Guillermo Chacón, (gchacon@correo.cua.uam.mx) and, for domestic participants, full RFC information.

Domestic participants:
Bank: Banco Nacional de México (Banamex)
Account number (Mexican pesos): 1866151 Sucursal 349
CLABE: 002180034918661519
Beneficiary: Sociedad Mexicana de Física A.C.
Reference: EDGFM16
The deposit amount must correspond to the fee that applies according to schedule above. The receipt will be produced in Mexican pesos.

International participants:
Bank: Banco Nacional de México (Banamex) Account number (US
dollars): 9345347 Sucursal 349
Swift code: BNMXMXMM
Bank code: 002180034993453470
Beneficiary: Sociedad Mexicana de Física A.C.
Reference: EDGFM16

PROCEEDINGS
The proceedings of the school will be published in the journal IOP Conference Series, of the Institute of Physics. Instructions and sample files to the required format may be found on the website (https://conferenceseries.iop.org/content/authors).

The extent of the contributions is free, but the following are suggested:
- Courses: 20 pages
- Plenary Talks: 10 pages

- Parallel Talks: 5 pages
Contributions must be written in English and will be peer reviewed. Papers should be sent to Miguel Sabido (dgfm@gmail.com) in PDF format, as well as the necessary permission to reproduce material from other publications, if required.

TRANSPORTATION
The best way to get to Playa del Carmen is by airplane to the Cancun International Airport http://www.cancun-airport.com/. From there you can take a shuttle or a taxi to go directly to Hotel Iberostar situated on Playacar, Playa del Carmen, or take a bus to Playa del Carmen and from there a taxi to the hotel, (approx. 60 min). The hotel Iberostar is 15 min away from Xel Ha, half an hour from Xcaret, 45 mins from Tulum, among others. Rivera Maya has a lot of touristic places like Maya ruins, beaches, adventure centers, etc., for more information, you can visit: http://www.visitmexico.com/en/mayan-riviera.

For further information contact the organizing committee (dgyfm.smf@gmail.com).
School page: http://www.ifug.ugto.mx/~msabido/XI_Escuela/

ORGANIZING COMMITTEE:

- Hector Hernández Hernández (UACH)
- Miguel Sabido (UGTO)
- Guillermo Chacón (UAM-C)

ADVISORY COMMITTEE:
- Dario Núñez (ICN-UNAM)
- Tonatiuh Matos (CINVESTAV-IPN)
- Hugo Morales (UAM-I)

LECTURE COURSES

- **Giovanni Amelino Camelia** (Sapienza University of Rome), *Recent advances in quantum-gravity phenomenology*
Abstract: My lectures will give an overview of the results obtained by quantum-gravity phenomenology over the last decade, which took this new field from near non-existence to a very active research area, involving several research groups internationally. Among the most recent developments, those that took shape over the last couple of years, I stress the significance of some studies of "spacetime fuzziness" and particularly of some studies using data reported by the IceCube neutrino telescope as an opportunity for testing the hypothesis of Planck-scale-deformed relativistic symmetries.

- **Viqar Husain** (University of New Brunswick), *Polymer quantization, time, and quantum gravity*
Abstract: I will describe the application of the background independent polymer quantization method to scalar field theory, cosmology, and black hole formation, and present several results. I will then apply a time deparametrization scheme using matter fields in canonical general relativity to obtain a model for quantum gravity.

- **Iván Agullo** (Louisiana State University), *Loop quantum cosmology and the cosmic microwave background*

- **Alan J. Weinstein** (California Institute of Technology, LIGO), *First results from advanced LIGO*
Abstract: We describe some of the results in gravitational wave astronomy from the first observing run of Advanced LIGO, including the discovery of the binary black hole merger GW150914, and what we have learned from studying it.

PLENARY TALKS

- **Craig Hogan** (University of Chicago), *Exotic Rotational Correlations in Emergent Space-Time*

- **Jorge Pullin** (Lousiana State University), *Loop quantum gravity with spherical symmetry*
Abstract: We review recent progress in loop quantum gravity with spherical symmetry, in particular the exact solution in vacuum of the quantum Einstein equations and its use to study quantum field theories on a quantum spacetime. Applications to Hawking radiation, the Casimir effect and the collapse of shells will be discussed.

- **Robert Oeckl** (CCM, UNAM), *Operational quantum gravity*
Abstract: In quantum theories of physics the relation between mathematical structures and observable phenomena is much less direct than in classical theories. In the well known and well tested quantum theories the notion of observable as an operator on a Hilbert space of states plays a central role in establishing this connection. However, the consistency of this notion of observable depends on a fixed temporal background structure, absent in a general relativistic setting. We discuss how approaches to quantum gravity have in the past and may in the future respond to this challenge. In particular, we discuss how recent advances in the understanding of quantum theory provide a new perspective.

- **Tim Koslowski** (ICN, UNAM), *The Shape Dynamics Description of Gravity*
Abstract: The standard description of Einstein Gravity in terms of spacetime geometry fails to be fully relational, because its physical interpretation requires "external" clocks and rods. It turns out that gravity can be derived from completely relational first principles. The resulting theory describes gravitational dynamics as an equation of state for a (unparametrized) curve in conformal superspace. Exploring this relational description using light physical clocks and rods (i.e. coupling weak matter fluctuations) yields an effective spacetime description that solves Einstein's equations but has a different domain of validity.

In particular, the equation of state of the curve on shape space provides an unambiguous evolution through the big bang.

- **Claus Laemmerzahl** (ZARM, Bremen University), *Analytic theory of accretion disks*
  Abstract: Since accretion disks can approach Black Holes much closer than stars they are an ideal tool to explore the strong gravity regime near to the Black Hole horizon. Accretion disks can be modeled by a fluid. A mathematically simple fluid is the perfect fluid. In this talk we describe the shape and the characteristic features of thick accretion disks around various types of Black Holes, like Schwarzschild, Reissner-Nordstrom, Kerr, Schwarzschild-de Sitter, Kerr-de Sitter, regular Black Holes and others, as well as around compact objects described, e.g., by the q-metric. For that also all characteristic circular orbits of particles have to be determined. We also give an outlook of how viscosity might be included and which types of effects should be expected. We also describe shortly the physics of thin disks.

INVITED TALKS

- **Volker Perlick** (ZARM, Bremen University), *Wave equations on Schwarzschild spacetime in regular coordinates*
  Abstract: Linearizing Einstein's vacuum field equation about the Schwarzschild metric leads to the Regge-Wheeler equation, which is usually considered in a coordinate system that covers only the region outside the horizon. Here I discuss the Regge-Wheeler equation in Eddington-Finkelstein and in Painleve-Gullstrand coordinates, which allow to construct analytic series solutions that cover the entire region from the singularity at the center to infinity. I discuss quasi-normal modes and Hawking radiation in this formalism.

- **Jorge Alfaro** (Pontificia Universidad Católica de Chile), *Bose-Einstein graviton condensate in a Schwarzschild black hole*
  Abstract: We analyze in detail a previous proposal by Dvali and Gomez that black holes could be treated as consisting of a Bose-Einstein condensate of gravitons. In order to do so we extend the Einstein-Hilbert action with a chemical potential-like term, thus placing ourselves in a grand-canonical ensemble. The form and characteristics of this chemical potential-like piece are discussed in some detail. After this, we proceed to expand the ensuing equations of motion up to second order around the classical Schwarzschild metric so that some non-linear terms in the metric fluctuation are kept. We argue that the resulting equations could be interpreted as the Gross-Pitaevskii equation describing a graviton Bose-Einstein condensate trapped by the black hole gravitational field. Next we search for solutions and, modulo some very plausible assumptions, we find out that the condensate vanishes outside the horizon but is non-zero in its interior. Based on hints from a numerical integration of the equations we formulate an ansatz and eventually find an exact non-trivial solution for a mean-field wave-function describing the graviton Bose-Einstein condensate in the black hole interior. Based on this we can rederive some of the relations involving the number of gravitons N and the black hole characteristics, summarized in its Schwarzschild radius, along the lines suggested by Dvali and Gomez. These relations are parametrized by a single parameter -a dimensionless chemical potential.